SKM600GAE12E4

SEMITRANS® 5

IGBT4 Modules

Engineering Sample

SKM600GAE12E4

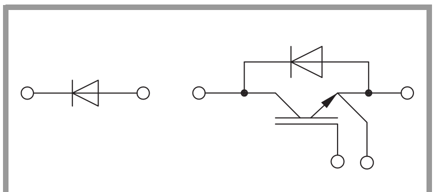
Target Data

Features

- IGBT4 = 4. generation medium fast trench IGBT
- CAL4F = Soft switching 4. generation CAL-diode
- Enhanced 900A free-wheeling diode
- With integrated gate resistor
- Isolated copper baseplate using DBC technology (Direct Bonded Copper)
- UL recognized, file no. E63532

Remarks

- Case temperature limited to T_c = 125°C max
- Recommended T_{op} = -40 ... +150°C
- Product reliability results valid for T_j = 150°



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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	T_j = 175 °C	T_c = 25 °C	913	A
		T_c = 80 °C	702	A
I_{Cnom}			600	A
I_{CRM}	I_{CRM} = 3xI_{Cnom}		1800	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V V_{GE} ≤ 15 V V_{CES} ≤ 1200 V	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C
Inverse diode				
I_F	T_j = 175 °C	T_c = 25 °C	54	A
		T_c = 80 °C	41	A
I_{Fnom}			50	A
I_{FRM}	I_{FRM} = 2xI_{Fnom}		100	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		180	A
T_j			-40 ... 175	°C
Freewheeling diode				
I_F	T_j = 175 °C	T_c = 25 °C	936	A
		T_c = 80 °C	695	A
I_{Fnom}			900	A
I_{FRM}	I_{FRM} = 2xI_{Fnom}		1800	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 25 °C		4320	A
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$			500	A
T_{stg}			-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, t = 1 min		2500	V

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
$V_{CE(sat)}$	I_C = 600 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.80	2.05	V
		T_j = 150 °C		2.20	2.42	V
V_{CE0}	chiplevel	T_j = 25 °C		0.80	0.90	V
		T_j = 150 °C		0.70	0.80	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		1.67	1.92	mΩ
		T_j = 150 °C		2.5	2.7	mΩ
$V_{GE(th)}$	V_{GE}=V_{CE}, I_C = 24 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V V_{CE} = 1200 V	T_j = 25 °C			5	mA
		T_j = 150 °C		-		mA
C_{ies}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		37.2		nF
C_{oes}		f = 1 MHz		2.32		nF
C_{res}		f = 1 MHz		2.04		nF
Q_G	V_{GE} = - 8 V...+ 15 V			3400		nC
R_{Gint}	T_j = 25 °C			1.3		Ω

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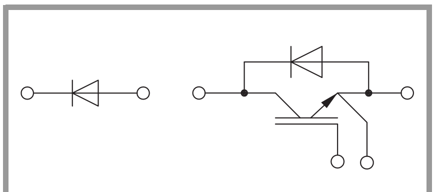

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Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
$t_{d(on)}$	V_{CC} = 600 V	T_j = 150 °C		195		ns
t_r	I_C = 600 A	T_j = 150 °C		91		ns
E_{on}	V_{GE} = +15/-15 V $R_{G\ on}$ = 2 Ω	T_j = 150 °C		81		mJ
$t_{d(off)}$	$R_{G\ off}$ = 2 Ω	T_j = 150 °C		695		ns
t_f	di/dt_{on} = 6000 A/µs	T_j = 150 °C		131		ns
E_{off}	di/dt_{off} = 5200 A/µs	T_j = 150 °C		83		mJ
$R_{th(j-c)}$	per IGBT				0.049	K/W
Inverse diode						
$V_F = V_{EC}$	I_F = 50 A	T_j = 25 °C		2.41	2.74	V
	V_{GE} = 0 V chiplevel	T_j = 150 °C		2.45	2.79	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		22	25	mΩ
		T_j = 150 °C		31	34	mΩ
I_{RRM}	I_F = 50 A	T_j = 150 °C				A
Q_{rr}	di/dt_{off} = 5500 A/µs V_{GE} = ±15 V	T_j = 150 °C				µC
E_{rr}	V_{CC} = 600 V	T_j = 150 °C				mJ
$R_{th(j-c)}$	per diode				1	K/W
Freewheeling diode						
$V_F = V_{EC}$	I_F = 900 A	T_j = 25 °C		2.14	2.46	V
	V_{GE} = 0 V chiplevel	T_j = 150 °C		2.07	2.38	V
V_{F0}	chiplevel	T_j = 25 °C		1.3	1.5	V
		T_j = 150 °C		0.9	1.1	V
r_F	chiplevel	T_j = 25 °C		0.93	1.07	mΩ
		T_j = 150 °C		1.30	1.42	mΩ
I_{RRM}	I_F = 600 A	T_j = 150 °C		384		A
Q_{rr}	di/dt_{off} = 5500 A/µs V_{GE} = ±15 V	T_j = 150 °C		83		µC
E_{rr}	V_{CC} = 600 V	T_j = 150 °C		47		mJ
$R_{th(j-c)}$	per diode				0.07	K/W
Module						
L_{CE}				15		nH
$R_{CC'+EE'}$	measured per switch	T_C = 25 °C		0.18		mΩ
		T_C = 125 °C		0.22		mΩ
$R_{th(c-s)}$	calculated without thermal coupling			0.02	0.038	K/W
M_s	to heat sink M6		3		5	Nm
M_t		to terminals M6	2.5		5	Nm
						Nm
w					310	g

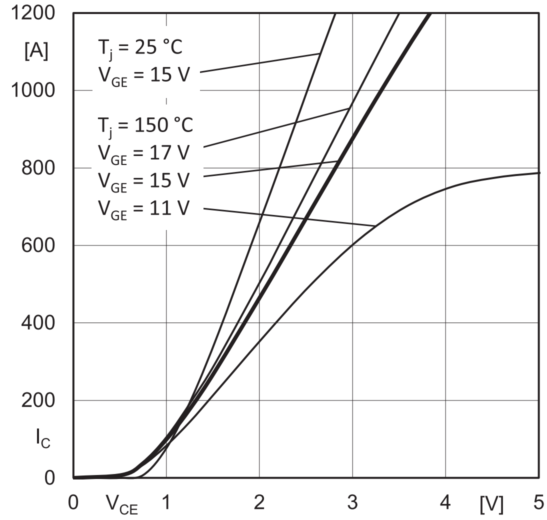


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

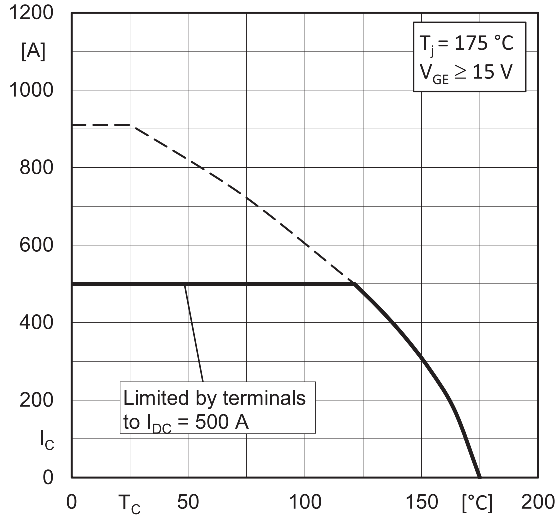


Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

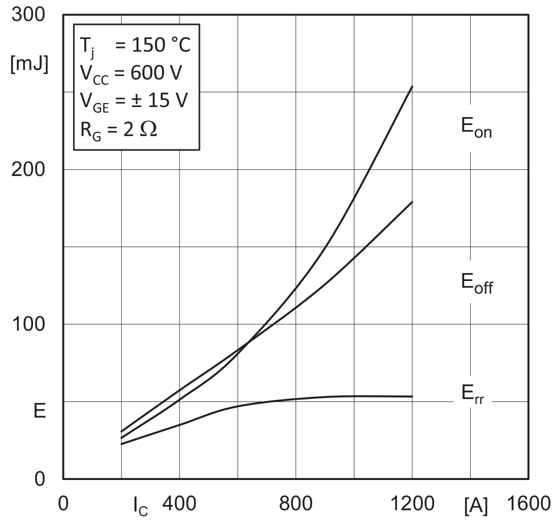


Fig. 3: Typ. turn-on /-off energy = f (I_C)

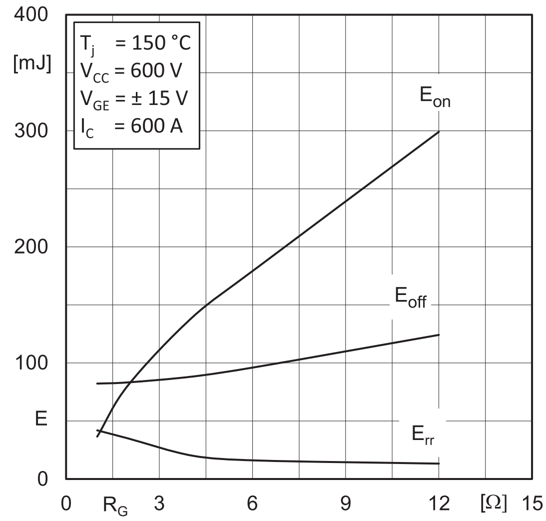


Fig. 4: Typ. turn-on /-off energy = f (R_G)

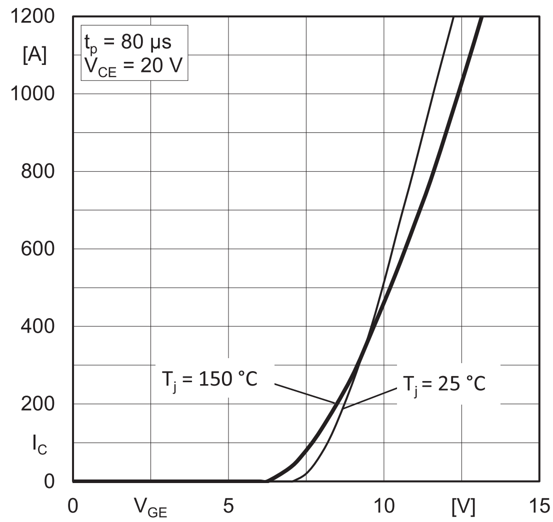


Fig. 5: Typ. transfer characteristic

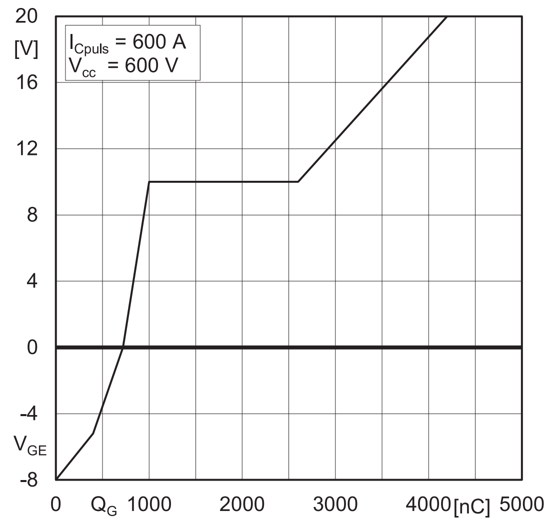


Fig. 6: Typ. gate charge characteristic

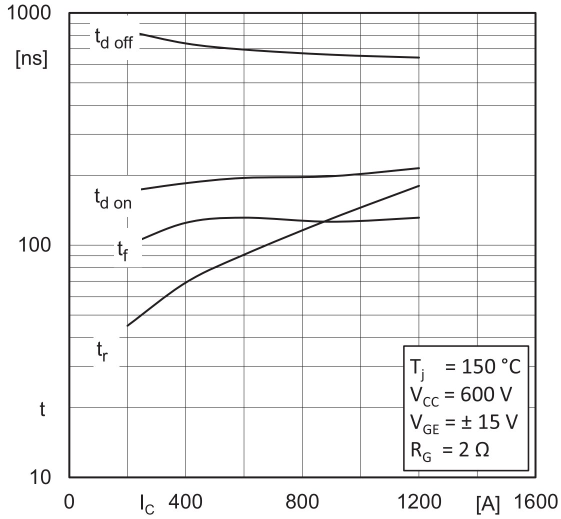


Fig. 7: Typ. switching times vs. I_C

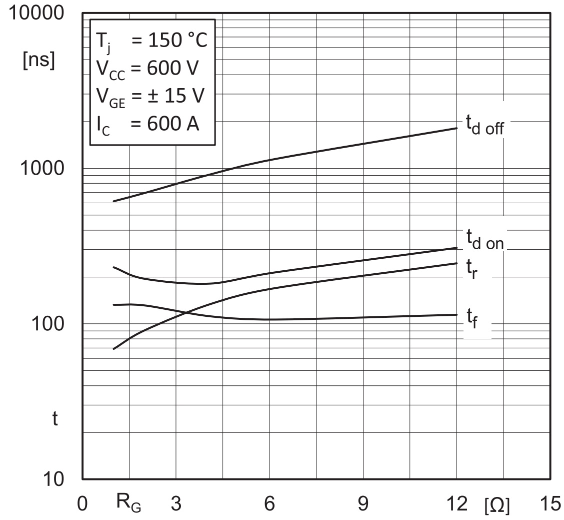


Fig. 8: Typ. switching times vs. gate resistor R_G

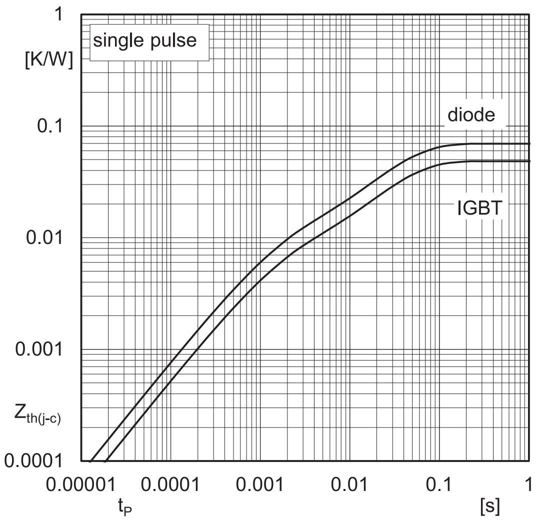


Fig. 9: Transient thermal impedance

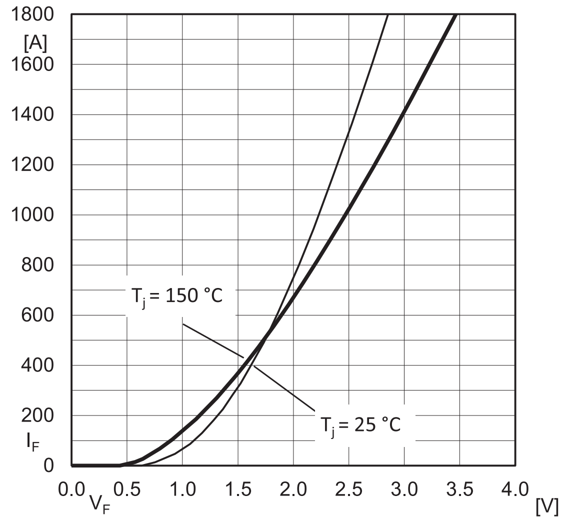


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

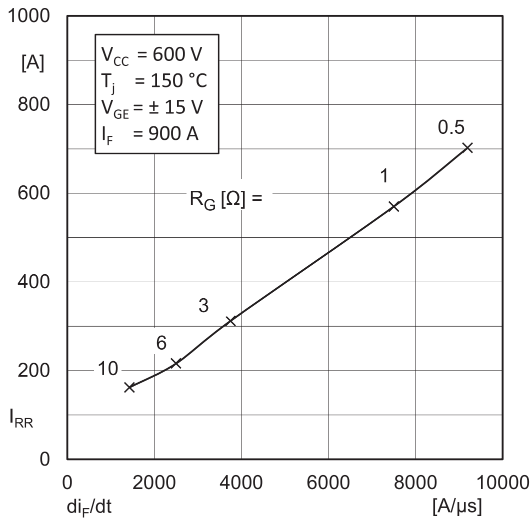


Fig. 11: CAL diode peak reverse recovery current

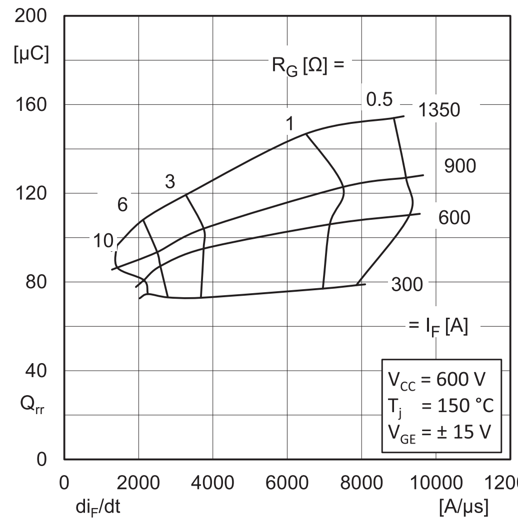
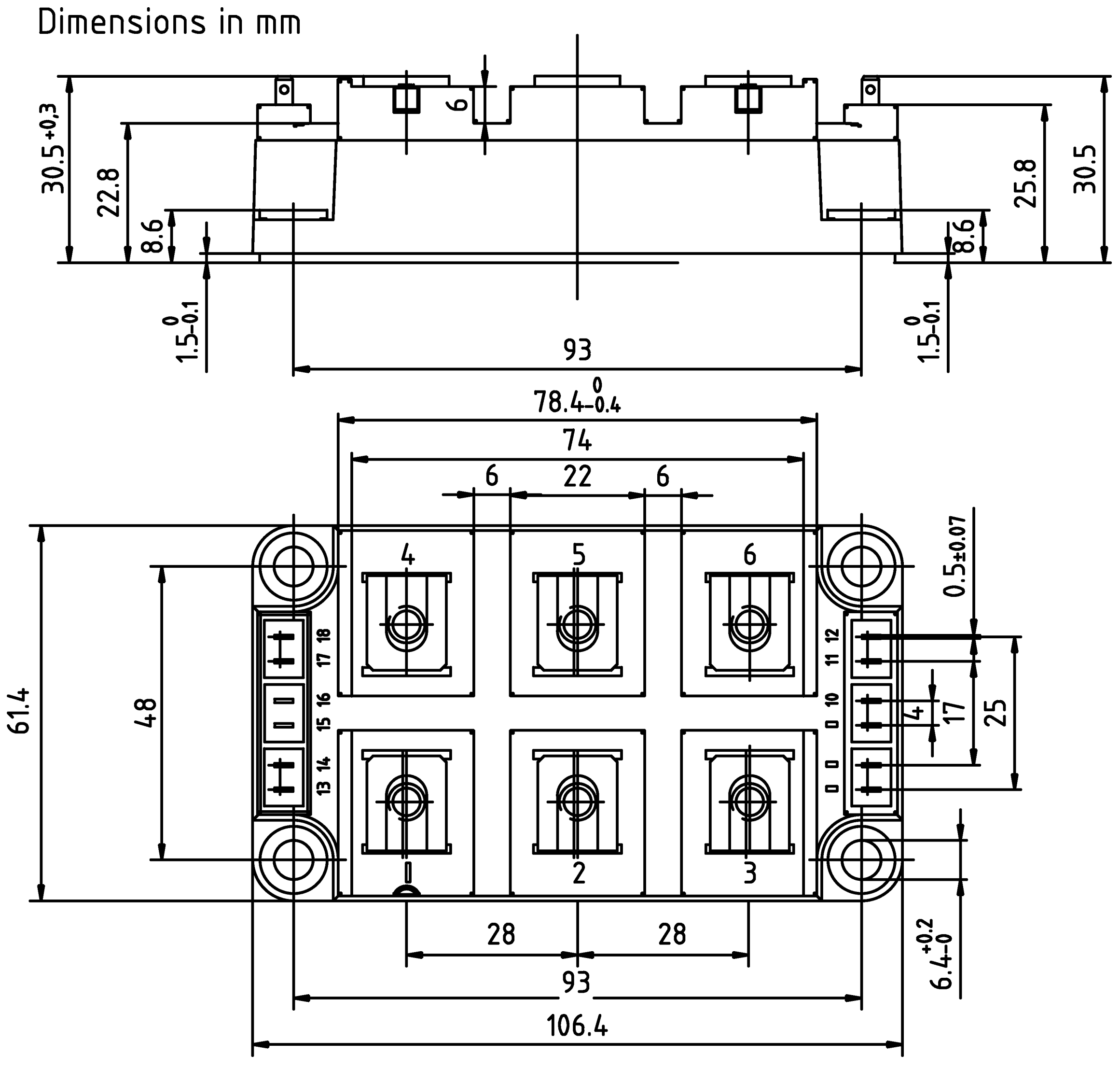


Fig. 12: Typ. CAL diode peak reverse recovery charge



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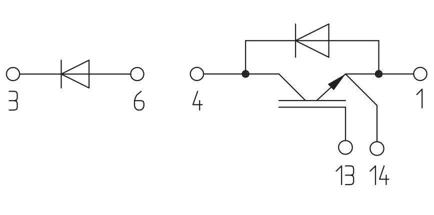

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This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

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